APPENDIX B

SIGNIFICANT ISSUE #2 FIRE - RISK TO LIFE AND PROPERTY

Fire and Fuels in the Templeman HFRA Project Area

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1. Introduction

The Templeman Hazardous Fuels Reduction project is located in T63N R1E Sections 12, 13, and 24 in the vicinity of Templeman Lake and Huckleberry Ridge, approximately 8 miles north of Bonners Ferry. The purpose and need of the project is to reduce fuels in the urban interface; the Templeman and Smith Lake areas are becoming increasingly populated and homes and other infrastructure surround the project boundary. The Camp Nine road accesses National Forest System Lands in the vicinity and is also an egress route for many adjacent landowners. In the event of a wildfire, travel routes could potentially be cut-off. Public and firefighter safety during a wildfire is the overarching goal of the proposed treatments.

The proposed action (Alternative 2) is to reduce fuels on approximately 1200 acres of National Forest System lands. This action would be accomplished through shelterwood, commercial thinning/sanitation salvage and group selection prescriptions utilizing ground-based logging systems in all treatment units with the exception of a skyline logging system on approximately 50 acres. In addition, nearly 300 acres that burned in the 1979 Templeman Lake Fire, and was subsequently re-planted, would be pre-commercially thinned under this alternative. Activity and natural fuels would then be treated through grapple-piling with pile burning in the fall on 320 acres and underburning on 450 acres, additional treatment of fuels would be through biomass removal and utilization.

A. Regulatory Framework

There are four guiding documents that establish the direction for fire management. These documents provide the framework for fire management and provide specific goals, standards, and objectives for implementing a fire management program. In addition, the local community has developed the Boundary County Idaho Wildland/Urban Interface Fire Mitigation Plan (August 2003) (discussed further in this section), which provides recommendations for projects such as this. Fire handbooks, guides, research, and technical papers provide further direction.

Guiding Documents	Direction
The IPNF Forest Plan	Provides standards and goals that Management Plans need to address on the Forest as well as provides Forest-wide and Management Area guidelines that define land uses.
The Forest Service Manual	Mandates all National Forests and lists objectives for fuels management.
Federal Wildland Fire Policy	Establishes standardized procedures and policies for Federal wildland fire management agencies.
National Fire Plan	Directs a comprehensive approach to the management of wildland fire, hazardous fuels, and ecosystem restoration on Federal and adjacent State, tribal and private forest and range lands.

Healthy Forests Restoration Act

The Healthy Forests Restoration Act authorize hazardous fuels reduction in the wildland-urban interface through collaboration, therefore, the Forest Service has a responsibility to work with local communities in order to focus fuels treatments in areas where the threat of fire to human life and property can be reduced.

IPNF Forest Plan

The IPNF Forest Plan objective is to implement efficient fire protection and fire use programs based on management objectives, site-specific conditions, and expected fire occurrence and behavior. The Forest Plan uses the term "Fire Use" in reference to management ignited fire, or prescribed fire. However, the term has evolved with implementation of the Federal Wildland Fire Management Policy and Program Review. 'Wildland Fire' is any non-structure fire that occurs in the wildland. 'Wildland Fire Use' is the management of naturally ignited wildland fires to accomplish specific pre-stated resource management objectives in predefined geographic areas outlined in a Fire Management Plan. The Idaho Panhandle Forest Plan (1987) does not provide direction for Wildland Fire Use on the Bonners Ferry Ranger District. However, the Forest Plan does provide for 'Prescribed Fire' – any fire ignited by management actions to meet specific objectives – NEPA requirements, a prescribed fire plan, and consultation with Fish and Wildlife Service and the public being complete. The following are the key standards currently guiding the IPNF fire management plan applicable to this area:

- *Human life and property will be protected.*

- *Fire will be used to achieve management goals according to the direction identified in management areas.*
- *Activity fuels will be treated to reduce their potential rate of spread and fire intensity so the planned initial attack organization can meet initial attack objectives.*
- *Fuel management fund expenditures are prioritized by: natural fuels that threaten human life and property, unfounded activity fuel projects, and areas where fuels or potential fire behavior is a threat to management area objectives.*

The primary objective for the fire suppression and fuels management program on the IPNF is firefighter and public safety (IPNF Fire Management Plan 2007, p. 12)

The primary Forest Plan Management Areas (MA1 and MA4) within the Templeman project area include goals to manage lands suitable for timber production for the long-term growth and production of commercially valuable wood products (MA1), some occurring within big game winter range (MA4). The majority of the proposed treatment areas are within MA1.

The fire protection standard to satisfy the goals of the management areas, and required for all unplanned wildland fire ignitions, is an Appropriate Management Response (AMR). The AMR is used to achieve the best benefit based on an evaluation of risks to firefighter and public safety, the circumstances under which the fire starts, resource objectives, values to be protected, and protection priorities. The fire management plan (FMP) outlines activities and procedures to meet the objectives. The AMR for an unplanned ignition generally ranges from aggressive suppression of unwanted fires to management as a wildland fire use event. However, in this area, wildland fire use is not approved; the risks to life and resources being too great. Therefore, the AMR would be a suppression strategy (confine, contain, or control). Prescribed fire is to be used as needed to meet silvicultural objectives and the objectives of the management area.

Forest Service Manual

Forest Service Manual (FSM) 5105 defines fuel as combustible wildland vegetative materials, living or dead. The objective of fuel management as stated by FSM 5150.2 is to identify, develop, and maintain fuel profiles that contribute to the most cost-efficient fire protection and use program in support of land and resource management direction in the Forest Plan. Methods used for controlling the flammability and intensity of a fire may include mechanical, chemical, biological, or manual means, including the use of prescribed fire and wildland fire use (FSM 5150).

Policies

The “Federal Wildland Fire Management Policy and Program Review” was chartered by the Secretaries of the Interior and Agriculture in 1995 to examine the need for modification of and addition to Federal fire policy. Fire suppression policy from the early 1900s until the late 1970s has been that of total suppression. Only recently has fire policy been modified to recognize the

importance of fire in balancing vegetation cycles within the temperate forest. The review recommended a set of consistent policies for all Federal wildland fire management agencies.

In adopting the policy, the Federal Agencies recognized the role of wildland fire as an essential ecological process and natural change agent that will be incorporated into the planning process (USDI and USDA 2001a). The severe wildfire seasons in recent years throughout the country have made it clear that fire cannot be excluded from fire-dependent ecosystems. On the other hand, because of developed areas, and commercial forests, fire cannot be fully restored to its historic character without severe consequences to humans, except perhaps in a few of the largest wilderness areas. The policy stresses human life as the first priority, property and resource values being the second priority. As proposed, fuels reduction will address these issues as described further on in this document.

Another key message in this policy is that wildland fire is a critical natural process and fire needs to be allowed to function in its natural role. In conjunction with mechanical treatments, the proposed action will utilize prescribed fire to not only reduce fuels, but reintroduce fire where it has been excluded.

National Fire Plan

The National Fire Plan (NFP 2000) originated after the record-breaking wildfire season of 2000. President Bush requested a national strategy for preventing the loss of life, natural resources, private property, and livelihoods in the wildland/urban interface. Working with Congress, the Secretaries of Agriculture and Interior jointly developed the National Fire Plan ***(www.fireplan.gov)*** to respond to severe wildland fires, reduce their impacts on communities, and assure sufficient firefighting capabilities for the future. The National Fire Plan (2000) includes five key points:

- Firefighting/ preparedness
- Rehabilitation and restoration of burned areas
- Reduction of hazardous fuels
- Community assistance
- Accountability

The NFP is a long-term commitment based on cooperation and communication among federal agencies, states, local governments, tribes and interested publics. The federal wildland fire management agencies worked closely with these partners to prepare a 10-Year Comprehensive Strategy. The four goals of the 10-Year Comprehensive Strategy are to

- Improve fire prevention and suppression
- Reduce hazardous fuels
- Restore fire-adapted ecosystems
- Promote community assistance

This project will address all of these goals to some degree, as described in the analysis of alternatives as related to fire and fuels management.

Community Wildfire Protection Plan

In response to the 10-Year Comprehensive Strategy goal to promote community assistance, Boundary County initiated a contract to develop a Wildland/Urban Interface Fire Mitigation Plan (Community Wildfire Protection Plan) to aid in the protection of the communities within the county
(Online:
http://www2.state.id.us/lands/nat_fire_plan/county_wui_plans/boundary/boundary_plan.htm).
The goal of the Boundary County Community Wildfire Protection Plan is to:

1. *Assess the wildland urban interface fire risk in Boundary County*
2. *Plan for mitigation of the fire risk*
3. *Prioritize treatments and mitigation of forest fuels*

The fire mitigation plan describes the community of Bonners Ferry and the municipal watershed, as being at high risk to wildfire loss. The Boundary County Community Wildfire Protection Plan defines urban interface as:

> "…two (2) miles outside places of human habitation and/or infrastructure to service these points of habitation. Infrastructure includes power and communication lines and towers, transportation routes for ingress, egress and evacuation, rail lines, and watersheds where citizen groups have organized for joint collection of water for domestic uses. In instances where topography immediately outside the 2-mile zone would allow "anchoring" to good fire control points, such as ridge tops or roads, the zone will be extended to the anchor point."

Therefore, the wildland-urban interface is not just defined as "an area or location where a wildland fire can potentially ignite homes" (Cohen, 1999). Although the ultimate responsibility of reducing the threat of home ignitability resides on the homeowners (Cohen, 1999), protection of infrastructure and egress/ingress routes that cross multiple ownership boundaries resides on all the entities they serve. Although there are residences within just a couple hundred feet of the proposed activity area, the Forest Service and other agencies have the responsibility to work with the local communities and fire mitigation program to reduce fuels and fire behavior on National Forest System lands because there is so much more at stake than the loss of homes.

B. Air Quality Regulatory Framework

Smoke from wildfire or prescribed fire contains air pollutants, including fine particulate matter, which can cause health problems, especially for people suffering from cardiopulmonary illnesses. Particulate concentrations that exceed health standards may occur for several miles downwind of prescribed burns. Smoke from prescribed burns may impact Class 1 airsheds, diminishing scenic vistas.

Clean Air Act

The framework for controlling air pollutants in the United States is mandated by the 1970 Clean Air Act (CAA), as amended in 1977 and 1990 (42 U.S.C. §7401 et seq.). In 1999, minor revisions addressed visibility in sections 7491 and 7492. These changes were published on July 1, 1999 as the Regional Haze Rules (64 FR 35741). The CAA was designed to "protect and enhance" the quality of the nation's air resources. The Act encourages reasonable Federal, State and local government actions for pollution prevention. State Implementation Plans (SIPs) are developed by each state to implement the provisions of the CAA. The SIPs describe the State's actions to achieve and maintain the "national ambient air quality standards" (NAAQS) established by the EPA (Envirnomental Protection Agency) for specific pollutants. In 2006, the EPA tightened the 24-hour standards for fine particles (PM 2.5) lowering it from 65 $\mu g/m^3$ to 35 $\mu g/m^3$. If a community or area does not meet or "attain" a particular standard, it becomes a non-attainment area and must demonstrate to the public and EPA how it will meet standards in the future – as stated, this airshed is in attainment.

Montana/Idaho Airshed Group

Boundary County is in Airshed 11 of the Montana/Idaho Airshed Group – the coordinated operations of this group being critical in accomplishing land management objectives while minimizing cumulative impacts of smoke from prescribed fire activities conducted by its members. Members of the Airshed Group enter all the burns they would like to accomplish for that calendar year during the pre-season within an internet based reporting system. During the burn season, members propose burns for the subsequent day and then the monitoring unit (along with the Idaho Department of Environmental Quality) considers all the proposed burns along with expected dispersion and ventilation and existing air quality to determine burn recommendations. These procedures limit smoke accumulations to legal, acceptable limits. The Bonners Ferry Ranger District strictly complies with these procedures.

Within Airshed 11 there are no areas of concern, non-attainment areas, or Class 1 airsheds. Class 1 areas include Forest Service and Fish and Wildlife Service wilderness areas over 5,000 acres that were in existence before August 1977 and National Parks in excess of 6,000 acres as of August 1977. Designation as a Class 1 area allows only very small increments of new pollution above existing air pollution levels. The nearest Class 1 airshed is in the Cabinet Mountains in western Montana – southeast of the project area. The Libby airshed impact zone is approximately 45 miles east.

2. Desired Conditions

Post-fire effects may be detrimental or desirable depending on when and where fires occur – the nature of fire in relation to the wildland urban interface and the management area objectives. Wildfires occurring in the project area during the hot and dry summer months would be more likely to burn with high intensities, creating control problems for firefighting resources and potentially unsafe conditions for firefighters and the public, as well as cause unwanted resource damage.

According to the IPNF Forest Plan, a desired condition is a sustainable forest system; in terms of fire management this reflects wildland fires that are of low intensity, provides for public safety and safety of our neighboring private lands and property (IPNF Fire Management Plan 2007, p. 12). One way for this to be measured is by expected fire behavior with the current fuels conditions, and how suppression capabilities, firefighter and public safety, and forest resources would be affected in the event of a fire.

When planning an activity, the intent is to either maintain a desired condition, or to trend towards it. It is important to note that if an area is outside of the desired condition – it may take several entries, such as periodic prescribed fire, to achieve it. The desired conditions as related to fire and fuels in the project area are described as follows.

A. Fuel Characteristics: fuel loading, species composition, structure, continuity

Desired fuel characteristics for this project are those where slow-burning surface fires would be expected in the case of a wildfire. This would be a result of light surface fuels, minimal ladder fuels, and spaced crowns to minimize torching, spotting and crown fire behavior. Thirteen Fire Behavior Fuel Models, developed by Rothermal (1972) and Albini (1976), and as described in Aids to Determining Fuel Models for Estimating Fire Behavior (Anderson 1982) are used in fire behavior prediction modeling for their physical description of the fuel loading, fuel bed depth, and fuel moisture at which fire will not spread to estimate potential fire behavior. The 13 fire behavior fuel models are for fire behavior estimation during the "severe period of the fire season when wildfires pose greater control problems and impact on land resources" (Anderson 1982). Recently, 40 dynamic fuel models were developed and are available for use in surface fire behavior predictions as well (Scott and Burgan 2005). Either is appropriate for modeling fire behavior if they fit the needs of the forested stands being modeled. The 13 fuel models described in Anderson (1982) are time tested and fit well for local forest types, therefore, fuel models are summarized by the Anderson descriptions for this project.

The desired timber fuel model is one with light timber litter in the surface fuels where low flame lengths and slow rates of spread would be expected. From the viewpoint of fuels management and fire suppression, a fuel model 8, as described later along with all the fuel models currently observed in the project area, best fits with the desired condition.

Although all forests in northern Idaho have experienced fire, certain species are more desirable from a fire management perspective. These include western larch and ponderosa pine, and to a lesser extent Douglas-fir. These tree species are generally early seral depending on forest type (Smith and Fischer 1997) and long-lived with the highest fire resistance of local tree species. They are better adapted to survive low intensity surface fire over some of the other tree species such as western redcedar, lodgepole pine, grand fir, and western hemlock to name a few.

B. Fire Regime Condition Class

The desired condition is a landscape where fire regimes are within a condition class 1 (0-33% departed from historic natural range), or trending in that direction, and the risk of losing key

ecosystem components to fire is low. A natural condition is one that native species are adapted to and where soil and hydrologic conditions are in sync (Interagency Fire Regime Condition Class Guidebook v1.2 2005). As described later, there are two dominant forest types within the project area – dry forest and moist forest. Each have a natural historic fire regime, ranging from low-intensity / high-frequency for the dry forest, to mixed-severity, and sometimes high-intensity / low-frequency fires for the moist forest type. For the drier forests, fuels treatments may help trend that fire regime towards an improved condition (especially when prescribed fire is used). In other cases, such as where average fire return intervals have not been missed (moister sites with return intervals upwards of 200 years), fuels reduction activities may not contribute towards an improved condition class (Franklin et al 2006), however treatments will still reduce fuels and modify fire behavior.

C. Suppression Capabilities

The current fire strategy on the Bonners Ferry Ranger District is suppression (confine, contain, or control) in the wildland urban interface, therefore, letting a fire burn in the project area is not an option. Utilizing direct attack to control a wildfire is the most desirable tactic to achieve the objectives for suppression in the Forest Plan. This is because suppression actions must hold life – firefighter and public safety – as the highest priority while minimizing resource value loss and economic expenditures. Direct attack to control a fire is the most rapid and aggressive approach to accomplishing these priorities.

D. Fire Behavior

Extreme fire behavior – torching, spotting, crowning – will affect the ability of fire managers to successfully meet the goals of fire suppression as stated above. Direct attack suppression is often an unrealistic method of control when extreme fire behavior is exhibited. Safe direct attack suppression by any resource (firefighter, dozer, aerial resource) is limited once flame lengths reach 11 feet (NFES 2165 – NWCG 2006, p. B-59).

In the event of a wildfire, desired fire behavior would be surface fire where flame lengths are at a level where the fire can be safely attacked directly – 4 foot flame lengths or less. Fuel treatments would decrease surface, ladder, and crown fuels such that lower surface flame lengths would be expected to prevent fire from reaching the canopy (Strom and Fulé 2007).

3. <u>Existing Conditions</u>

This portion of the document describes the current project area landscape as it relates to fire and fuels. This includes the different forest types and how fire influenced the growth, development, and renewal of each historically and how post-European influence, such as fire suppression, introduced insects and disease, and timber harvest, has likely contributed to the condition of the fuels and expected fire behavior related to those conditions.

Knowledge of fire behavior is important, as severe summer wildfires continue to burn millions of acres every fire season in western forests – the wildland urban interface continues to become a point of concern. Global climate change is another issue that fire managers will be faced with, as

warmer climates may bring longer periods of drought and longer and more extreme fire seasons, not to mention shifts in species composition resulting in changes in fire behavior and fire effects. Fire seasons over the past few years have shown that large stand-replacing fires are becoming normal and expected. Some historical studies suggest forested ecosystems tend to experience stand-replacing fires when associated with warmer climate periods (Pierce et al 2004). Therefore, fire managers may have an increasing responsibility to modify the one factor of fire behavior that can be managed – the surface, ladder, and crown fuel characteristics.

The current condition of the factors that affect fire behavior, specifically the fuels; as well as the fire regime condition class and current fire suppression capabilities for the Templeman analysis area are described as follows.

A. Methodology

The existing condition of fire and the fuels associated with the Templeman HFRA analysis area was determined using archived fire data, GIS coverages and associated attributes, stand exams, as well as from data collected within the project area and fire behavior prediction models.

Field Data

Site specific data for the analysis area was collected to determine existing fuels characteristics such as fine and heavy fuel loads and canopy base heights. Site visits for fuels conditions were done on several occasions – specifically 04/27/05, 07/18/05, and 07/29/05, as well as on 07/10/07 and 09/24/07. Fuels transects to sample down woody fuels were done using Brown's transect protocol (1974). Latitudes and longitudes for fuels plots locations were recorded by GPS so that plots can be re-evaluated for changes in fuel loadings post-treatment. Where appropriate the field data was used to assess fire hazard and potential fire behavior through fire behavior modeling and corroborate model results. Field data is available in the project file.

Fire Behavior Modeling

Several tools are available for predicting surface fire behavior; from basic fire nomograms to computer based models. Many different programs incorporate the same underlying surface fire behavior model which was described in *A mathematical model for predicting fire spread in wildland fuels* (Rothermel 1972). Use of these models can help managers identify hazardous fuels and set priorities for management or suppression tactics during a wildfire. As with all models, capabilities vary and assumption and limitations exist (available in the project file), but knowledge of fuels, weather, and other site specific conditions, as well as accuracy of model input data can provide for useful fire behavior predictions.

The Forest Vegetation Simulator (FVS) is used by forest managers to predict the effects of various vegetation management actions on future forest conditions. It uses actual stand exam data to predict forest growth and decline over time. It is an intricate model with many capabilities, therefore, much more information on the use of this model is provided

in the project file. **The Fire and Fuels Extension (FFE) of FVS was used in this analysis**; it integrates existing models of fire behavior and severity into FVS (Reinhardt and Crookston, 2003). Model outputs displays fuels and stand structures, as well as potential fire behavior over time and allows for comparison of various treatment alternatives to the same stands. It was used to describe the existing condition, as well as the effects of the proposed treatments within each alternative and effectiveness of treatments on fuels conditions and fire behavior into the future of the stands modeled.

Because FVS-FFE simulates vegetative responses based on site specific information and a number of various management actions, it was used to model the current condition and the effects of no action and the proposed action on fire behavior indicators including flame lengths, probability of torching, and crowning index.

BehavePlus version 3.0.2 (Users Guide – Andrews, Bevins, Seli 2005) was used to show surface fire flame lengths and spread rates between the existing, or baseline, fuels conditions and post-treatment fuels, especially where FVS outputs were not available due to missing stand exam information. Model outputs were summarized and fire model printouts are available in the project file. Input values for weather (temperature, relative humidity, fuel moistures, wind), topography (slope, aspect, elevation), and fuels (fuel models) all affect surface fire behavior predictions. Model capabilities, limitations, and assumptions for this analysis are available in the project file. The modeling scenarios assumed a 'high' fire danger scenario as these are the times that fires pose the greatest resistance to control.

The **First Order Fire Effects Model (FOFEM5)** is not a fire behavior prediction model, but rather quantifies those effects that are immediately realized during a wildfire, such as mortality, fuel consumption, soil heating, and smoke emissions. The model was used to compare the smoke impacts of a wildfire burning under the current conditions as well as burning in a treated stand after implementation of the proposed action and compares the emissions due to wildfire, underburning, and pile burning based on the different methods of treating the fuels or leaving the stands untreated.

B. Fuel Characteristics: fuel loading, species composition, structure, continuity, etc.

Due to slope, aspect, and associated terrain and vegetation, it is possible that several different fuel models were present historically in the project area – representing three of the main fuel model groups where grass, shrubs and brush, or timber litter would have been the main carriers of a surface fire.

Moist and dry habitat groups are represented in the project area. Although they differ in species composition, where previously untreated they have the same basic structure and fuel composition – abundant ladder fuels and surface fuels and the potential for extreme fire behavior.

Dry Habitat Groups

Approximately 50% of the project area is considered dry forest habitat. Units 3, 4, and 4a are dominated by dry site vegetation on south and southwest facing aspects where frequent surface fires (approximately 40 year return interval) historically kept surface fuels under control (Arno and Fiedler 2005). Surface fuels would have likely consisted of grasses and brush under open-grown ponderosa pine and larch. Although grass fuel models can have high rates of spread, there is generally no post-flaming combustion, thus little severity to soil, water, or wildlife resources. Fuel model 5 exists where some previous harvest activities have occurred – these areas can have high rates of spread and flame lengths depending on the availability of the fuels to burn (moisture content), which would be greater during high fire danger. Abundant tall brush, or ladder fuels, increases the fire hazard because it limits the space between the surface fuels and the aerial fuels (tree crowns). As time passes between fires (or fuels management), dead timber litter accumulates and contributes to carry a wildfire. Under this condition, fuel models change, becoming a fuel model 8 (timber with light timber litter), fuel model 9 (compacted pine needle litter) or a fuel model 10 (timber with heavy surface fuels).

Currently, there are patches of fuel models 2, 5, 8, and 10 – the amount of dead and dying and ladder fuels contributing to a fuel model 10 (described below). Oceanspray, ninebark, maple, and other shrub and herbaceous vegetation common to south and west aspects dominate the understory fuels, with thick patches of Douglas-fir reproducing successfully in areas. All of these surface fuels (see Table 1 below for averages of fine fuels) are competing with the overstory vegetation for nutrients and available water. Deep duff is accumulating (due to missed fire cycles in can be 4 times greater than historic levels) (Smith and Fischer 1997) and will contribute to burn severity by holding heat in the ground.

Moist Habitat Groups

The project area is comprised of approximately 50% moist sites that are situated on north to northeast aspects and flat slopes and are dominated by fire-intolerant species. Cedar and hemlock are dense, and dead and dying trees, as well as low-growing crowns have created abundant ladder fuels. Fuel loadings and coarse woody debris are highest on these sites, thus hot-dry conditions create a fire hazard due to low fuel moistures in heavy fuels.

Currently, **the untreated moist habitat types in the project area are a fuel model 10**, or timber with heavy surface fuels (this determination was made with data and associated photographs gathered through numerous site visits – field notes in project file). This fuel model exhibits more intense and severe surface fire behavior than does the other timber litter models under high fire danger conditions (Anderson 1982). A dense forest canopy, heavy timber litter, and suppressed regeneration could contribute to a surface fire with high mortality and high severity. Under periods of high fire danger, extreme fire behavior such as torching, crowning and spotting would likely be observed with the current fuels situation. Due to the continuity of these fuels, this type of fire behavior not only poses a

threat to the public, but to fire fighting resources as well. See project file for photographic examples of the described fuel models.

Fuel Model 10

Figure 1 (Dry site on left) and **Figure 2** (Moist site on right). Examples of fuel model 10 – photos taken in the project area.

Fuel Loading: Coarse-woody debris and 1, 10,100 hour fuels by forest type

Coarse-woody debris (dead standing and downed pieces greater than 3" in diameter) is an important component of a healthy ecosystem. Animal life processes, site productivity and protection, as well as fire, are important components most commonly discussed by forest managers (Brown, Reinhardt, Kramer 2003). Observations of past fire behavior shows that small woody material, less than 3" in diameter, has the most substantial influence on fire behavior (such as spread rates and fire intensity), which can be accurately predicted with surface fire behavior models. However, large woody fuels can contribute to large fire development and high fire severity. The greater the fuel loading of this large material, coupled with the size and decay rate, can greatly influence fire severity (effects to soil, water, other forest resources) – this is generally due to smoldering and persistent burn periods (Brown, Reinhardt, Kramer 2003).

Coarse Woody Debris

>3" diameter material

Forest Type	Ave.	Recommended
Dry	10.8	6.6 – 13.2
Moist	27.8	16.5 – 33.0

Coarse Woody Debris calculated in tons/acre

For the dry sites decay rates for dead, down woody material are generally lower than they would be on moister sites, especially in the absence of fire (Brown, Reinhardt, Kramer 2003). Although the amount of CWD throughout the project area varies quite considerably (field notes available in the project file), the **average is 10.8 tons/acre for the dry habitat groups and 27.8 tons/acre for the moist habitat groups** (units 5 and 6 having the greatest amounts – some areas with loads greater than 50 tons/acre). Recommendations by Graham et al. (1994) for these sites are 6.6-13.2 tons/acre and 16.5-33.0 tons/acre respectively. Although CWD falls within the recommended range for each habitat type, these recommendations are for desirable

biological benefits – but there must be a balance as to not create an unacceptable fire hazard (Brown, Reinhardt, Kramer 2003). Crowning out, spotting, and torching are more frequent with heavy CWD leading to control difficulties.

Fine fuels are continuous throughout, in the form of twigs, small branches, live and dead brush and grasses, and pine needles. As mentioned, these fine materials will contribute to the overall fire spread, especially on the drier sites where the forest floor is littered with ponderosa pine needles and the dominate surface vegetation is pine grass and brush. Small fuel loads can be summarized by fuel model – the majority of the current untreated portions of the project area can be classified as fuel model 10 (Anderson 1982). FVS is also a reliable tool for summarizing fuel loads, as it models data collected from stand exams. The following table summarizes the average load of small diameter fuels for a typical untreated, dense stand in the project area from FVS.

Table 1. Summary loading of small dead fuels in tons/acre for typical untreated stand in project area

Smaller Surface Fuels (<3" diameter - dead)	(Tons/acre)
1 hr (0-.25")	2.0
10 hr (.25-1.0")	1.3
100 hr (1.0-3.0")	3.25
Total Surface Fuel (<3 inch)	6.5
Duff	34.6

Canopy Base Heights

Canopy base height (CBH) is the lowest height above the ground where there is a sufficient amount of canopy fuel to transition a fire from the surface fuels into the tree crowns. Therefore, low canopy base heights are a critical factor in determining crown fire potential. Fuels treatments should focus on removing some or all of the ladder fuels and other vegetation that contributes to a low canopy base height, especially where reducing crown fire initiation is a priority. Canopy base heights were determined across the project area from on-site observations, and on **moist sites** they **are as low as 1 foot.** The structure and species composition of the stands – specifically cedar and hemlock with low growing crowns, as well as dense understory trees – are contributing to the low canopy base heights observed. **Drier sites** in the project area tend to have greater variation in stand structure, but canopy base heights are still low due to the tall shrubs and understory trees and **average 3 feet** for fire behavior predictions**.** The fuels continuity from the surface fuels to the crown fuels has created the potential for surface fire to propagate to the crowns of the overstory trees.

Canopy Bulk Density

Canopy bulk density (CBD) is the mass of available fuel per unit of canopy volume (kg/m3). It is a bulk property of a stand, not an individual tree. Canopy bulk densities

Canopy Base Heights (CBH)

The lowest height above the ground in feet at which there is a sufficient amount of **canopy fuel** to propagate fire vertically into the canopy. It is an effective value that incorportates ladder fuels such as the shrubs and understory trees.

Canopy Bulk Density (CBD)

The mass of **available canopy fuel** per unit canopy volume. It is a bulk property of a stand, not an individual tree. Measured in kilograms per meter cubed – kg/m^3.

were assumed from estimates in FFE-FVS for representative stands within the project area. It is a difficult canopy characteristic to measure directly (short of cutting down the trees); FVS uses a technique to estimate "effective" CBD in nonuniform stands from a stand inventory that does not assume a uniform vertical distribution of canopy fuel – uniform measurement can be estimated by dividing canopy depth into canopy load (Scott and Reinhardt 2001).

Scott and Reinhardt (2001) describe the criteria necessary for active crown fire: Mass-flow rate is defined by Van Wagner (1977) as the rate of fuel consumption through a vertical plane within the fuel bed and it is a product of CBD and spread rate. CBD affects the critical spread rate needed to sustain active crown fire. If the mass-flow rate falls below a certain threshold, active crowning is not possible. Therefore, the lower the canopy bulk density, the lower the potential for active crown fire. This increases the **crowning index – or windspeed at which active crown fire is possible** – so it would take greater winds to sustain active crown fire once the canopy bulk density is decreased in a stand. The current canopy bulk density is displayed in the table below. It is assumed that treatments that remove overstory trees will also effectively lower the CBD – for example, if 50% of the canopy is removed, then it is assumed the canopy bulk density is decreased by 50% on average. However, this relationship can vary quite a bit depending on species removal, as some species obviously have much more mass in the canopy than others.

Table 2. Current CBH and CBD in the project area

Canopy Base Height (feet)
1 - 3
Canopy Bulk Density
0.1 - 0.2

C. Fire History

Fire is an essential form of disturbance in all western forests. Vegetative structure, function, and processes depend on it. Several conifer species are dependent on fire for

regeneration – including ponderosa pine, western larch, western white pine, and lodgepole pine. Dry, moist, and even high elevation forest succession is dependant on fire frequency, fire severity, and fire scale. There are three types of fires that occur in forested ecosystems (Zack and Morgan 1994):

Lethal fires *– fires that are stand replacing, removing 90%+ of the live tree dominant upper canopy layer across >90% of the stand across a large, relatively uniform scale. These are commonly crown fires that burn with high severity. Local examples of these types of fires are the Sundance and Trapper Peak fires of 1967 that together burned over 80,000 acres in a short time period during drought conditions*

Non-lethal fires *– fires that kill 10% or less of the dominant tree canopy. A much larger percentage of small understory trees, shrubs, and forbs may be burned back to the ground line.*

Mixed severity fires *- fires that commonly burn with variable severity across the landscape, producing irregular, patch mosaics; killing more than 10%, but less than 90% of the dominant overstory tree canopy. Fire regimes are considered variable – a short return interval non-lethal fire may occur with occasional long interval lethal crown fires.*

In the Western United States, millions of acres of forests have accumulations of fuels that are much greater than historical conditions – due to various forms of fire exclusion (Peterson et al. 2005). The fuel build-up has led to an increase in catastrophic wildland fire risk (Pollet and Omi 2002). The Myrtle Creek Fire in 2003 is a good example of a fire burning in heavy, abundant, and generally continuous fuels (Fire Behavior and Weather Report – Myrtle Creek Fire 2003). Another local example is the 1967 Sundance Fire which started on September 1st and grew from 4,000 acres to nearly 56,000 acres in 12 hours, burning across the entire Pack River Drainage and other areas of the Selkirk Mountains just missing Bonners Ferry. During the period of the fastest spread, the fire burned at a rate of a square mile (640 acres) every 6 minutes and produced a column of smoke that rose 35,000 feet into the air.

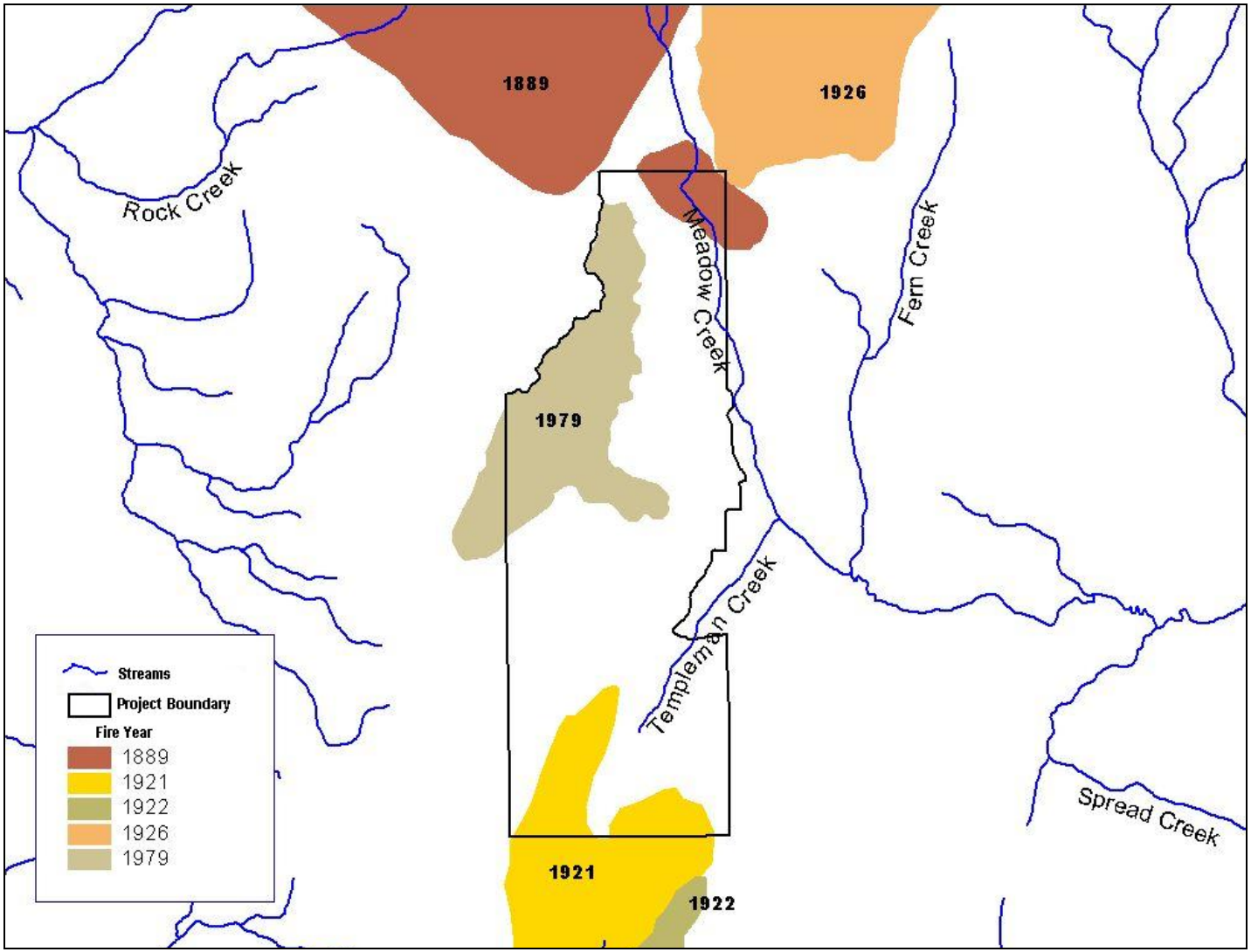
Wildfires are becoming more intense and severe, specifically in areas that did not historically experience landscape scale stand replacing fire, such as dry-site ponderosa pine stands in the western United States (Arno and Fiedler 2005, p. 36). Because of the existing conditions as previously described, there is the potential for wildfires to exhibit a high resistance-to-control – the more intense and severe the fire, the greater the number and type of resources needed to suppress it. These forests generally have vegetative conditions that seem to be fitting for crown fire behavior – low growing crowns and other ladder fuels, dense canopies, large amounts of heavy timber litter, etc.

Large fire events have occurred in the vicinity of the analysis area throughout history –as recent as 1979, when approximately 400 acres burned near Templeman Lake. However, other than that fire, the local fire atlas shows very little recorded fire history within the project area boundary. Therefore, it is likely that the role of fire has been removed to some degree by fire suppression – especially in the drier forest types.

The Templeman Lake fire burned intensely with rapid rates of spread. Prior to the fire, the stands were similar in structure to the untreated stands in the area today – high surface, ladder, and

crown fuels. Some locals who remember the fire as firefighters had to stand back and watch and believe that if it wasn't for the fire burning into previously treated and thinned stands, the fire would have continued burning north at a rapid and uncontrollable rate of spread (Scott Bacon, Idaho Department of Lands, personal communications). The previously thinned stands slowed the fire to a point where fire crews could safely attack it and it was contained. The majority of the fire growth of the 400 acre fire occurred in one afternoon – the observed behavior of the fire was extreme – torching, crown fire with running crown fire, and spotting ahead of the fire all occurred. Twenty-eight years have passed since this fire – twenty-eight more years of fuel accumulation in the untreated adjacent stands. Empirical evidence suggests it would not be unrealistic to expect fire behavior of a similar or even more severe degree in adjacent stands to what was observed for the Templeman Lake fire in the summer of 1979.

Figure 3. Fire History for the Templeman HFRA Project Area. Major events in and adjacent to the area include fires in 1889, 1926, and 1979.



The forest types in the Templeman HFRA analysis area have varied fire regimes; the drier sites experienced generally short cycles of low-intensity or non-lethal fires, and occasional stand replacing fires may have occurred as well. Moist cedar-hemlock forest types experienced longer interval mixed and high-severity, lethal fires; however low-intensity fires would have played a role in these forest types as well (Smith and Fischer 1997) (Franklin et al 2006).

D. Fire Regime Condition Class

Fire Regime Condition Class (FRCC) is a qualitative measure describing the degree of departure from historical fire regimes, possibly resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, canopy closure, and fuel loadings. Departure can be caused by any number of sources such as introduced exotic species, introduced insects or disease and management activities. Depending on forest type, it can be an indicator for fuel reduction needs and can help prioritize treatments to improve overall landscape condition class (Hann and Strohm 2003).

Fire Regime Definitions:

I 0-35 years and low to mixed severity
II 0-35 year frequency and high severity
III 35-100+ year frequency and mixed severity
IV 35-100+ year frequency and high severity
V 200+ year frequency and high severity

Although this project is defined as being within the wildland-urban interface, the Healthy Forests Restoration Act also calls for expedited fuels treatments in areas classified as Condition Class 2, Fire Regimes I, II, or III and Condition Class 3, all Fire Regimes.
Fire regimes and condition classes were analyzed for the Templeman project area at a larger scale than just the proposed treatment area of 1200 acres. Scale is an important factor when looking at departure of a historic range for any particular value – because in the case of fire – disturbance doesn't occur at the same time on all stands and at the same intensity when it does occur, there is natural variation (Interagency Fire Regime Condition Class Guidebook). For example, dry-sites dominated by ponderosa pine may have an average low-intensity fire return interval of 20-40 years historically. However, this is an average of all the dry site forest across a landscape. Some portions may have just experienced a fire – where only a small portion burned with severe effects and the remainder did not – and other stands may have not experienced a fire for several decades.

FRCC was determined at a scale of approximately 7600 acres, most of which is within the Meadow Creek watershed (6th code HUC). Although roughly 50% of the proposed treatment area is dry-site and 50% is moist site, nearly 75% of the larger FRCC landscape is moist site. Fire regimes were determined using habitat groups as the basic level of stratification – there were four strata – dry, moist, cool/moist, and cold/dry forests. Within each there is a reference (historic) value for fire frequency, fire severity, and vegetative structure (early seral, mid-seral closed, mid-seral open, late seral open, late seral closed) and the three together make up the weighted strata condition class. The weighted sum of the strata departure then makes up the overall landscape level FRCC rating. A more thorough explanation of the process and assumptions that went into the FRCC analysis is available in the project file.

Data gathered in the field and knowledge of current frequency of fire and expected fire severity has led to the determination that the FRCC at the project level is moderately (condition class 2; moist habitat type groups are in fire regime III and dry habitat groups are in fire regime I) altered from the natural range across the Templeman area. The main contributors to this rating are fire exclusion, the reduction in white pine due to blister rust which has affected stand structure and species composition, and past timber harvest. Other than the area that burned in 1979 and very small portions that burned in 1889 and 1921, it was assumed for the FRCC analysis that fire has been excluded from the remainder of the project area for at least 120 years (no records before 1889). As mentioned, this has affected the dry sites where at least two fire cycles have been missed and long-lived seral species such as ponderosa pine are the ecosystem components at moderate risk of being lost due to fire regime condition class departure.

Figure 4. Current FRCC percent departure from natural range

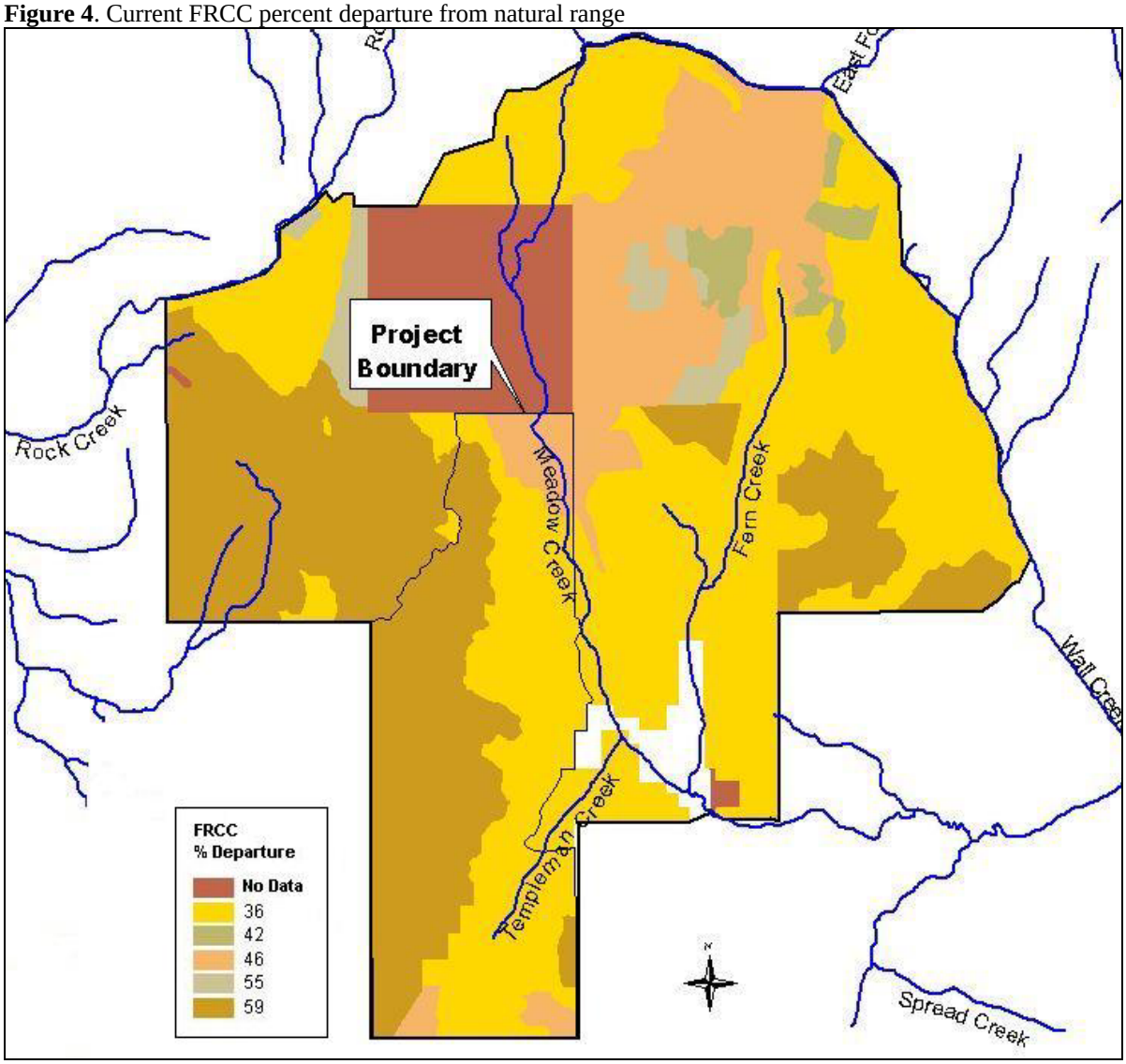


Table 3. FRCC departure by major forest type represented

	Fire Regime*	Condition Class Departure (Weighted)
Moist	**III-V**	**40% (FRCC 2)**
Dry	**I**	**59% (FRCC 2)**
Landscape Departure (Weighted) **FRCC 2 – 40%**		

*The Fire Regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning – thus, it is a constant measure for a particular vegetation group and does not change regardless of condition class.

E. Fire Behavior

The following section summarized the expected fire behavior based on the current condition of the fuels modeled under fire danger scenarios typical of hot and dry North Idaho fire season. We model it this way because that is the time when fires pose the greatest threats to firefighters and the public and have the greatest potential for spread and extreme fire behavior – it allows the best opportunity to compare the effectiveness of fuels reduction activities.

Surface Fire Behavior

Under the existing fuel conditions, surface fires in the event of a summer wildfire would exhibit behavior that would limit direct attack to ground machinery and aerial resources only. Expected flame lengths would be greater than the limit that can be safely attacked by handcrews – **predicted flame lengths would be greater than 5 feet and the limit for safe direct attack by firefighters is 4 feet**. Longer flame lengths generally mean greater rates of spread, especially if the fire moves into the tree crowns. Fast moving fires are generally more difficult to control, and in the wildland urban interface, create an even greater concern as fires may threaten homes and other structures as well as escape times out egress routes.

Similar results would occur in the dry forest types, as fuel structures are generally similar. Although overall fuel loading is generally less in these stands, they are more open to the elements such as solar radiation and drying of fuels due to the generally west to south aspects.

Crown Fire Potential

Crown fire potential is generally based on the amount of surface fuels, the amount of ladder fuels – which serve as the avenue to move surface fire into the tree crowns, and the density and spacing of the overstory. Heavy surface fuels generally contribute to longer flame

3 Key Fuels Factors for Crown Fires

- How much surface fuels?
- How close are the trees crowns to the ground?
- How dense are the tree crowns?

lengths. As mentioned above, if canopy base heights are low, those surface flames can then carry into the tree crowns. Once there, a crown fire may persist if the structure of the canopy is such to support crown fire. The more spaced the canopy, the greater the wind necessary to move fire from one crown to the next. Dense canopies would obviously require much less windspeed to support crown fire.
The condition of the project area is such that a crown fire could be supported due to the current surface, ladder, and crown fuels. The predicted flame lengths coupled with the low canopy base heights of 1-3 feet would equate to a **high probability of torching of the canopy (>90%)**, thus **potential mortality to the overstory trees would be between 60-100%**.

Plantations

The fire behavior in the existing moist plantations within the project area would be much different than would be expected in the mature untreated forests. The regeneration is relatively uniform in size and structure. Fire behavior would be similar to that of a fuel model 8 (desired condition fuel model), as much of the surface fuels were removed in the previous entry. **Surface flame lengths would average <2 feet.**

Figure 5. Templeman Lake Fire Plantation

The canopy structure of the smaller trees in this forest type is such that crowns are developed down to the surface fuels and much of the regeneration is on a 5-10' spacing, surface fire with torching would be the expected fire type. The plantation is a mix of conifer species – mostly lodgepole, western larch, western white pine and Douglas-fir, but also species generally referred to as late seral like western redcedar and hemlock.

The plantation created from the Templeman Lake fire in 1979 (proposed unit 7) – now a mix of immature conifer – would exhibit somewhat different fire behavior than the moist plantations. It is currently dominated by ponderosa pine and lodgepole in patches, as well as larch, lodgepole and Douglas-fir in others. The average size is less than 7"; therefore, these trees are not merchantable as saw logs. The stocking is dense – at a spacing of approximately 5 feet. The trees have a high crown ratio – the crowns extend the length of the boles for the most part, thus canopy base heights are very low – approximately 1 foot. Whereas the moister plantations have a rich layer of live surface fuels - the surface fuels in this stand vary – much of the area is covered in dead pine needles and pine grasses, and very little brush or coarse-woody debris.
Fire behavior would vary throughout, as is described in the fuels above. Individual and group torching would occur more frequently in these stands and surface fire behavior would be more intense with **approximately 3 foot flame lengths** – coupled with canopy

base heights generally less than a foot, a torching situation would be likely in the untreated plantation. The probability of mortality is between 35-95%.

4. <u>Environmental Consequences – Effects of the Alternatives</u>

Three indicators of fire hazard were used to evaluate the changes in fire behavior by alternative. First, **potential flame length** was used to determine surface fire potential and the trends of surface flame lengths over time as a measure of treatment effectiveness over time. Suppression tactics are directly related to flame lengths, as fires with flame lengths less than 4 feet can be attacked using hand crews to construct fire line. Flame lengths greater than 4 feet would require other resources, such as dozers or other mechanical equipment or aircraft carrying water or retardant (NFES 2165, NWCG 2006 p. B-59)

The second indicator for fire hazard in the analysis is the **probability of torching**. A torching situation is generally defined as one where tree crowns of larger trees are ignited by surface fire flames or flames from smaller burning trees reaching the larger trees. Canopy base heights are a critical factor for determining the potential for torching. The torching index is calculated by conditions of surface fuels, fuel moisture, and windspeed. Torching is sensitive to surface flame length, understory development and ladder fuels, and crown structure. Management actions that modify these processes will change the predicted value of the torching index and the probability of torching with a forested stand. As it is a measure for large trees, it was not used in the analysis of the effects of the alternatives on the plantations.

The third indicator of fire hazard is the **crowning index** which is the wind speed, 20 feet above the canopy at which crowning is possible (Duveneck and Patterson III 2007). This index reflects the density of the canopy fuels. It is an important measure for evaluating the effectiveness of fuels treatments because crown fires generally exhibit rapid rates of spread, cannot be attacked directly due to fire intensity and they consume the crowns of trees, they result in nearly complete mortality of the overstory. This type of fire behavior may be acceptable outside of the wildland urban interface or in wilderness or back country situations. However, due to the resistance-to-control, unpredictability, resource damage, and especially the danger that crown fires pose to firefighters and the public, crown fires are unwanted in the urban interface and boundary of an at-risk community where people reside.

The crowning index is the point at which active crowning – a solid wall of flame extending from the fuel bed surface through the top of the canopy (Scott and Reinhardt 2001) – is possible, not necessarily the point at which it can be initiated. Passive crown fire usually happens first, where individual or small groups of trees torch out.

Fire Behavior Indicators:

- Flame Length
- Probability of Torching
- Crowning Index

All indicators listed above need to be considered in conjunction with one another. For example, over time surface fuels will accumulate at the greatest rates, and therefore predicted surface flame lengths may steadily increase. However, if ladder fuels are not present and the canopy fuels are spaced, the potential for torching

and active crown fire may remain low. The table below summarizes the effects by alternative on the indicators of fire behavior.

A. Effects Common to Both Alternatives

Fuel Accumulation

Regardless of the alternative chosen, fuel build-up will continue indefinitely in the Templeman HFRA project area as stands go through succession. An action alternative would reduce fuels in the near-term and an assessment for future entries would be needed as fuel treatment benefits are known to lapse due to surface fuels accumulation and other stand changes (Agee 2002). Obviously forest type and other environmental and human factors will affect the rate at which that occurs. Not all areas will need mechanical re-treatment – some areas may only need a subsequent prescribed underburn to maintain fuels. At any rate, the no action alternative will not address the current fuels hazard and the affected area would be at an elevated potential of a large, uncontrollable (unwanted) wildfire due to increased fire intensity associated with higher fuel loads, which would hamper fire suppression efforts. One of the main objectives for the Templeman HFRA project is to protect resources in the wildland urban interface from the effects of intense wildfire behavior.

Probability of Ignition

Probability of ignition is strongly related to fine fuel moisture, air temperature, shading of surface fuels, and an ignition source (Graham, McCaffrey, Jain, 2004). Implementation of the treatment alternative will not affect the likelihood of lightning strikes; however the risk of human caused fires may increase to some degree depending on how completion of the chosen alternative affects public access and use in the area. Regardless of the alternative chosen, ignitions would still be expected across the proposed action area. Altered stand structure can affect stand temperature and humidity – there is generally a warmer and dryer microclimate in more open stands (Graham, McCaffrey, Jane 2004). Dense stands, such as those with no record of past management or fire, generally have more shading of the surface fuels and higher relative humidity and air temperature (thus, higher surface fuel moistures) (Graham, McCaffrey, Jane 2004). An open forest structure would have contributed to the maintenance of ponderosa pine and other fire-dependent forests – where fire starts may have been common due to an increased probability of ignition, but intensities and severities were generally lower due to maintained surface fuels. The proposed action would aim to mimic these surface fuel conditions. Even with a fire start in areas treated under the proposed action, fire spread would be expected to decrease due to projected slower rates of spread and lower flame lengths. In the case there is an ignition and resulting wildfire, spotting that accompanies crown fire will be reduced because of modified surface, ladder, and canopy fuels.

Lightning is the main cause of fire occurrence on National Forest System lands on the Bonners Ferry Ranger District - >90% of all fires are ignited this way. When considering the probability of fire, it is better to consider the probability of burning, because that includes fires moving from elsewhere into this particular area. The district fire organization takes suppression action on approximately 21 fires every fire season (averaged since 1941). On average, 1 fire is reported within a reasonably close vicinity to the project area every year, usually in the Camp Nine area. Large stand replacing fire events occurred in 1889, 1921, 1922, 1926 and 1979. Between 1889

and 1926 a large fire occurrence occurred on average of every 9 years. Successful fire suppression began shortly after the 1926 fire, thus fires were kept under control until 1979 when that one escaped initial attack. The large gap in fire between 1926 and 1979 can probably be attributed to the success of fire suppression. However, if we include the 1979 fire, stand-replacing fire occurrence would be expected on average of 22 years in proximity to the project area – we are now 6 years past that average. This type of assessment is much different than if we analyzed the probability of any one particular acre of the project area burning – a number that is rather small and often used to argue that risk doesn't justify fuels treatment. Although a percent probability of fire occurring was not determined – Dr. Mark Finney (Research Forester at the Rocky Mountain Research Station) summarizes the idea of probability as follows:

> The summation of probabilities must be taken over time – many decades in fact. Probabilities may exceed 100% for a large fire somewhere in the project area if the summation is performed over a few 1000's of acres and one or two decades.
>
> He states there are problems with conclusions based only on the probability of an event. Fire occurrence is the frequency of fires within a specific area and period of time, and implies nothing about the fire size or probability of burning at a given geographic location (Finney 2005). The probability of ignition is not the same as the probability of burning. The probability of ignition is lower, yet National Forests still require funding for suppression forces. They fight fire because the consequences of having free-burning fires are felt well beyond the immediate ignition location and for reasons that are unrelated to the probability per acre.

The probability of a fire occurring in the project area may not be high, especially due to its relatively small size. Regardless, some may feel any chance of fires occurring in the project area with the current fire hazard and the predicted fire behavior is a risk not worth taking for public safety reasons.

Access for Suppression Resources

Success in initial attack relies heavily on arrival time to a fire. Well maintained roads allow for safer travel and allow for a variety of resources to support a fire, including the larger Type 4 engines (750 gallons of water) used on the Bonners Ferry Ranger District. Although road maintenance will be necessary to accomplish treatments, no new permanent roads are proposed for this project, thus access routes for suppression resources will not change. However, an open canopy and reduced surface and ladder fuels allow for quicker and safer foot travel to and from wildfires not accessible from an engine or other vehicle.

Influence of Topography and Weather on Fire Behavior

There are two contributing factors to wildfire behavior that cannot be controlled regardless of the action taken or alternative chosen for this project – the topography (elevation, aspect, parent material, etc.) of the project area and the daily and seasonal weather contributing to fire danger. However, modification of fuels and opening of a stand can affect microclimate, especially wind and solar radiation, influencing surface fuel moistures.

The Templeman project area is oriented with the prevailing wind direction - typical winds are light to moderate from the southwest. This orientation to the wind may aid in fire spread and general fire movement is to the northeast. Strong winds are generally associated with cold fronts, which can have an effect on fire behavior due to shifts in wind direction and downdrafts. More open stands created with fuels treatments would generally have greater surface winds than adjacent dense stands, affecting rates of spread and fire intensities based on that factor alone. However, the effect of the increased wind on fire behavior is offset by the reduction in the fuel load.

Slopes in the proposed treatment area are gentle to moderate, although a small portion is steep enough that it would require skyline harvesting (unit 4a). However, the majority of the project area has slopes less than 35%. Slope is a large contributor to spread of a fire – without wind, the greatest fire spread in uniform fuels will be in the direction of maximum slope. The slopes and aspects in the project area will contribute to the general northeast fire spread for this landscape.

B. Direct and Indirect Effects

Fire Regime Condition Class

Fire Appendix A, attached at the end of this document, displays how the FRCC (condition class) would change from the current condition (as shown in Figure 4 above) after implementation of the proposed action. The following table summarizes the effects of both alternatives on the FRCC departure. The No Action alternative would be the same as the current condition. A contributor to the improvement overall and on dry-sites for the proposed action is due to the use of prescribed fire on a portion of the landscape where the frequency is departed from what would have been historically. It is important to note that the purpose and need for this project is to reduce fuels in the wildland urban interface – an improvement trend in FRCC with the proposed action is an additional benefit, but not the objective of this project.

Table 4. Fire Regime Condition Class departure by forest type within the project area.

	No Action		Proposed Action	
	Fire Regime*	Condition Class Departure	Fire Regime	Condition Class Departure
Moist	III-V	40% (FRCC 2)	III-V	39% (FRCC 2)
Dry	I	59% (FRCC 2)	I	50% (FRCC 2)
Landscape Departure (Weighted Average) 40% (FRCC 2)			Landscape Departure (Weighted Average) 37% (FRCC 2)	

FRCC 2 means moderate departure (34-66%) from natural range; both alternatives are within the range for FRCC 2. Scale of the treatment area in relation to the landscape area in which FRCC is evaluated will impact the expected improvement from implementing treatment. Approx. 1200 acres of the 7600 acre FRCC landscape will be treated (<16%)

Suppression Capabilities – Flame Lengths

The proposed action will effectively modify the fuels characteristics of the treated area to be consistent with that of a fuel model 8 (light timber litter – see Figures 6 & 7 below) rather than a fuel model 10 (heavy timber litter) such as the current condition where previously untreated. In some areas that are currently represented by patchy surface fuel models (portions of the dry sites as described previously); effective reduction in expected surface flame lengths will best be achieved by underburning. Fire behavior will also be modified such as in the tables and text that follow.

Table 5. Suppression capabilities based on expected surface flame lengths by forest type and Alternative.

	Surface Flame Lengths (Feet)			
	No Action	**Direct Attack?***	**Proposed Action**	**Direct Attack?**
Moist	5.5	No	1.7	Yes
Dry	4.0	No*	1.4	Yes
Plantations	2.5	Yes	1.2	Yes

*4.0 feet is the limit of safe direct attack by hand crews – for the current condition of the dry-sites, the average expected surface flame lengths are at the limit, the dense moist sites are above it. In addition, this is an average produced by a model – some areas may exhibit surface fire intensities lower or higher than this as it is unlikely that any of these flame length predictions would be consistent during a fire. The currently low canopy base heights could propagate the surface flame lengths into the crowns of trees, thus overall flame lengths could be much higher (20-50 feet) with torching/crowning. The same would be true for the plantations due to the low canopy base heights. Direct attack by any means would not be possible under a crowning/torching scenario.

a. Effectiveness depending on type of post-harvest treatment (i.e. piling or underburning)

The effectiveness of treatment in reducing fuels and altering fire behavior is dependant on the type and intensity of treatment. Fuels reduction activities that include the use of prescribed fire are generally the most successful in reducing fuels (Graham et al. 1999). Prescribed fire consumes branchwood, duff and other dead material on the forest floor, as well as brush and other herbaceous material which contributes to fire intensity and severity. Prescribed underburning will be the most useful tool on the drier sites where the stands are already a bit more open and the understory vegetation has become most established – prescribed fire will be effective at reducing the surface fire intensities of a wildfire.

Harvest alone only treats the ladder and canopy fuels and does little to address the surface fuels. Slashing, combined with biomass utilization or grapple-piling and pile burning are also effective methods of treating surface fuels, both natural and activity created – however it is not as affective in reducing the fine fuel loading (the smallest branchwood

material) as is prescribed fire. This project proposes to use prescribed underburning on 450 acres and pile burning on 320 acres to address surface fuels after harvest of the overstory. The following figures show both types of activity fuels treatments on dry and moist sites.

Figure 6. Example of treated dry-site on district – fuel model 8 after treatment

Fuel Model 8 – Proposed Treatment

Figure 7. Example of treated moist-site on district – fuel model 8 after treatment

The above figures show an example of effectively reducing the surface, ladder, and crown fuels in both dry and moist forest types on the Bonners Ferry Ranger District through mechanical treatment followed by underburning (Figure 6) and grapple-piling and pile burning (Figure 7). These two figures can be compared to those on page 11 of this report – the current condition of the same forest types within the project area.

Crown Fire Potential – Probability of Torching and Crowning Index

The following table summarizes the probability of torching and crowning indexes by alternative and forest type. Fuels treatments will remove the majority of the ladder fuels, thus raising the canopy base heights to approximately 40 feet – a level where surface flame lengths would not be able to move into the tree crowns except for under rare scenarios of extremely high winds. In addition, harvest of the overstory trees will effectively space tree crowns, reducing the likelihood of fire spread from one tree to the next as shown in the increased crowning index (wind necessary to sustain crowning) in the proposed action as compared to the current condition (no action).

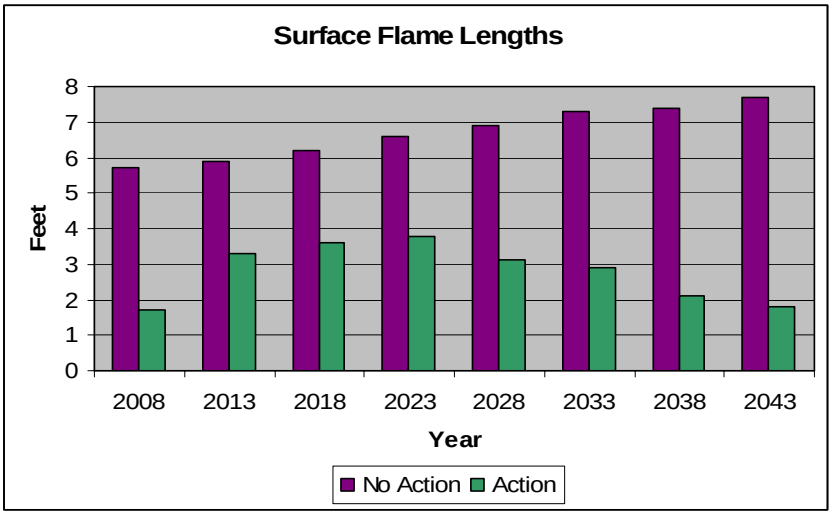
Table 6. Summary: probability of torching and crowning index by alternative – a range that includes moist and dry forest types.

	Probability of Torching	**Crowning Index (mph)**
No Action	**90%**	**16-20**
Proposed Action	**0-15%**	**50-100+**

Effectiveness into the future

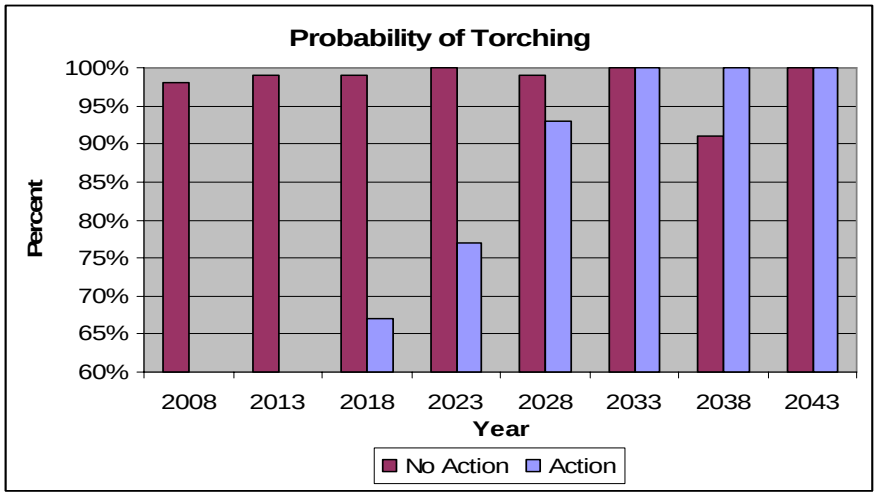
As mentioned, fuels reduction activities are expected to lapse. The following graphs compare the general effectiveness of the action alternative with the no action alternative for the indicators of surface flame lengths, probability of torching, and crowning index into the future.

Figure 6. Comparison of the general effectiveness by Alternative on the *Surface Flame Lengths* in the treatment areas.



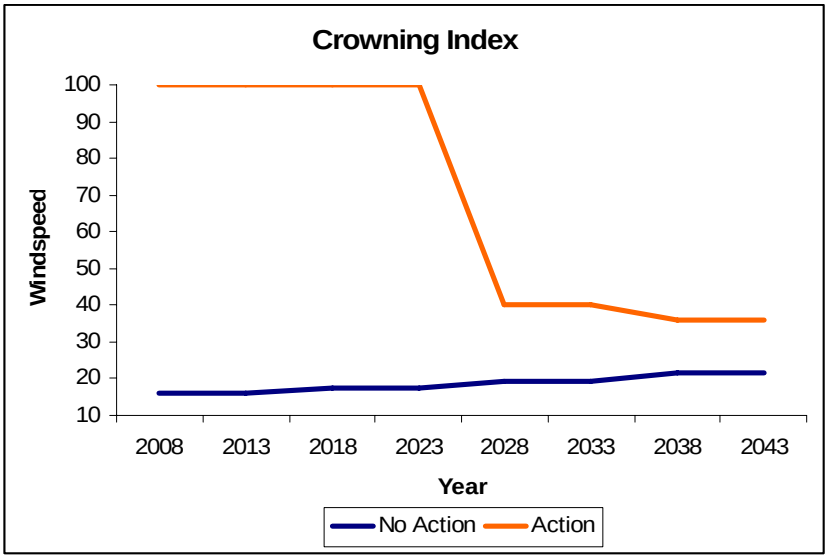
Project related activities would be effective at keeping the expected surface flame lengths under the direct attack threshold for at least 35 years into the future. Without treatment the expected surface flame lengths increases almost linearly from approximately 5.5 feet to 7.5 feet for the next 35 years. This is likely due to the fact that the dead and dying timber currently standing will begin to fall over and increase the amount of woody surface fuels.

Figure 7. Comparison of the general effectiveness by Alternative on the *Probability of Torching*



The initial entry will have an immediate effect on the probability of torching – reducing it to zero in the treatment year for approximately 10 years. It then increases to approximately 65% - this being a result of regeneration contributing to the ladder fuels under the residual overstory. Within this timeframe an additional entry would be necessary to once again reduce the likelihood of torching the tree crowns.

Figure 8. Comparison of the general effectiveness of the Alternatives on the *Crowning Index.*



The proposed action would increase the crowning index to a level where crown fire would be nearly impossible. This graph shows a windspeed ceiling of 100 mile/hour – FVS actually predicts the crowning index in the treatment units to be greater than this at initial entry time – meaning a wind event of over 100 miles/hour would be necessary for crown fire to occur in these stands. It would remain at this level for approximately 15 years where it would then decrease to roughly 40 miles/hour – still relatively high. Over the next 35 years the crowning index would still remain approximately 20 miles/hour greater than if the project area were left untreated.

Use of prescribed fire only

In previous fuels reductions projects, several groups have expressed their support for an alternative that would propose prescribed fire only as a method for achieving fuels reduction objectives. In some cases the task of implementing prescribed fire without any mechanical treatment beforehand would be feasible – with many constraints that would first need to be considered; including:

1. Wildland Urban Interface

   The project area is surrounded by private property with some local residences within a couple hundred feet of the proposed units. In order for fire managers to consider implementing prescribed fire with the current fuels conditions without first mechanically treating the ladder and crown fuels, extensive control lines would have to be established. These would need to be wide enough to account for single and group torching (and therefore spotting) which would likely occur by trying to use prescribed fire in a crown fire environment (Ron Hvizdak 2007). The risk of escape

would be high, putting private property, as well as firefighter and public safety at risk.

2. Time of Year / Weather

   In order to meet the objectives of reducing fuels in the surface and ladder fuels using prescribed fire only – while minimizing mortality to the overstory – timing of the burn would have to be done during such a time that the fuel moistures were low enough to consume the desired fuels, yet high enough to prevent extreme fire behavior that could occur due to the fact that fuels are so abundant. Likely, a very small window would exist for meeting the pre-determined parameters of wind, temperature, relative humidity, and fuel moistures. For example, an unpredicted wind gust could create undesired fire behavior by moving fire into the tree crowns. Burn windows are already fairly narrow in order to meet air quality standards. In addition, complexity would be high, and implementation of such a burn would likely have to occur over several days, maybe several burn seasons.

3. Firefighter Safety

   Prescribed fire, although done under a controlled situation within certain parameters of an approved burn plan, can be risky to fire managers – as fire can be unpredictable, especially if there are deviations from forecasted weather and other unexpected environmental factors. Firefighter safety is always the number one goal during burning or suppression activities. Certain hazards – such as falling snags, rolling materials, smoke inhalation, etc – have to be evaluated prior to ignitions. If prescribed fire only were used as the method of fuels reduction, the risk of falling hazard trees would be highly elevated over first treating the stands mechanically. Hazard trees are often removed during harvest activities if the operators feel like they cannot safely be worked around. An untreated stand would have many more hazard trees than a treated stand, as one of the objectives of the proposed action is to remove dead and dying trees. Fire weakens dead trees – falling trees are generally the single greatest threat to firefighters during a control burn. Therefore, the complexity and risk to firefighters would have to be evaluated before ignitions occurred.

Other issues, such as prolonged smoke impacts, exist for limiting the opportunity to use only prescribed fire as a means of fuels reduction in the wildland urban interface. However, the single most important constraint would be the risk it would pose to firefighter and public safety.

C. Air Quality

The *No Action* alternative proposes no activity for fuels reduction, therefore smoke impacts are not associated with this alternative. The only smoke impacts within the

project area under alternative 1 would be those associated with a wildfire burning in the project area – the particulate matter of which is shown below.
The treatment alternative proposes pile burning and prescribed underburning as methods of fuels reduction post harvest. Consumption of fuels due to these activities would release particulate matter into the atmosphere and compromise air quality to some degree. Pile burning generally occurs in the fall, when such activities have less of a negative affect on air quality. Spring burning is generally more limiting and many restrictions make for short burning windows.

Table 7. Total smoke emission (PM 10 and PM 2.5) for project related activities by Alternative

Forest Type & Activity	Emission in Tons/Acre	Total Emissions
No Action	0	0
Dry / Underburn	0.97	437
Moist / Pile Burn	1.33	424

The following table then summarizes the amount of particulate matter (10 and <2.5µm) released in the treatment area during a wildfire by forest type for the no action alternative and also a wildfire burning in the area after the completion of the proposed action.
Table 8. Summary of emissions during a wildfire by alternative

Wildfire	Emissions (PM 2.5 and 10) in	Total Emissions (Tons)
No Action		
Dry	0.78	586
Moist	2.03	850
Proposed Action		
Dry*	0.27	203
Moist**	1.02	428

*Includes Biomass thin acres (450 dry-site harvest acres + 300 acres biomass thin). Table 7 above did not include the biomass thin acres because underburning will not take place on these acres.
**Includes plantation acres (320 moist-site harvest acres + 100 acres plantation). Table 7 above did not include the plantation acres because grapple-piling will not take place on these acres.

The above tables show that the amount of emissions released per acre during a wildfire is slightly less than for the underburn – likely for two reasons. Slash fuels

would have been added post harvest during an underburn; thus more fuels to smolder longer. The second reason likely being time of year – fuels will smolder longer, prolonging the consumption of the fuels creating a longer period of smoke when the fuels are wet. When they are dry – like during a summer wildfire – they will burn out more quickly creating less overall emissions for that particular area.

5. Past, Present, Reasonably Foreseeable

Timber Harvest and Development
The Camp Nine road is used to access most of the Templeman HFRA project area. Much of this right-of-way and adjacent land is privately owned and development has increased in this area over the past few years.

There are several homes and outbuildings adjacent to the project area and it is reasonable to assume that development will continue. Although there are no structures within the treatment area, the proposed treatment, as designed will facilitate the FireSafe work that has been accomplished around private residences by reducing expected spread rates and intensities of a wildfire, as well as reduce the predicted fire type from a torching or crowning fire down to a surface fire. The activities proposed for this project will only occur on National Forest System lands – fuels work on private land would need to be accomplished by other means.

Fire Suppression

This project is within the wildland urban interface of Boundary County, thus fire suppression is the appropriate management response for unplanned ignitions.

Although fire can be a valuable tool for restoring fire adapted ecosystems and as a means for fuels reduction, wildfire is unwanted where the risk to life and property is a realization. Therefore, the strategy of total control fire suppression will continue in this area into the future.

Agricultural and Private Burning

Open burning season is from October 21st to May 9th annually and many rural residents choose this time to burn ditch lines, brush, timber litter and other woody and herbaceous materials on their land. Air quality will continue to be affected by these burning activities on private and public land into the future.

Fire Occurrence

Approximately 90% of all fire ignitions on National Forest System lands managed by the Bonners Ferry Ranger District are lightning caused. Every summer, thunderstorms bring lightning and fires are generally expected across the district. In addition, this area is used by locals and forest visitors for recreation and other

purposes – both lightning and human caused fires will likely occur within and adjacent to the project area into the future.

6. Cumulative Effects Related to Fire and Fuels

A. No Action

a. Departure from condition class

The No Action alternative will have no benefit on Fire Regime Condition Class in the present because it provides no method for moving the landscape towards a natural range of departure. As each year passes from the current, the departure will become even greater, especially on dry sites that are departed from fire frequency. A wildfire event could affect the fire regime condition class, but it is not possible to assume whether a wildfire in the project area would have a benefit or a negative affect on condition class – it would depend on the range of a fire, as well as the intensity and severity to forest resources. Furthermore, it is not possible to predict when and where a fire will occur on the landscape in the future.

b. Fuel Accumulation & Fire Suppression

As forests cycle through stages of growth, development, and mortality, fuels are continually accumulating in all vegetative layers. Without treatment, this accumulation will only add to the already heavy fuels within the project area, increasing the fire hazard by more than is already present. Fire suppression will be a continued reality within the project area regardless of the alternative chosen, as it is in a developed part of Boundary County in the heart of the wildland urban interface and adjacent to completed Fire Safe projects. The appropriate response to wildfire in this area will be full-control suppression for the foreseeable future. As mentioned, without natural or prescribed fire in which some of these stands depend on a rather frequent basis, fuels will continue to accumulate in all layers adding to the fire hazard.

B. Proposed Action

a. Short term risks of fuels on the ground

Although an immediate decrease in the amount of ladder and aerial fuels will be realized post-harvest, a short-term increase of surface fuels from limbs, tops, and slashed material created from logging activities will increase the surface fire hazard before these fuels can be either grapple-piled or underburned. This short-term increase of fuels will not occur in units where the purchaser is required to or opts to remove these fuels at the same time harvest takes place.

The fire hazard from untreated activity fuels can be mitigated in several ways, one being that fuels reduction projects in the urban interface are

considered high priority for the district fire management organization and treatments of these fuels takes precedence over fuels outside of the wildland urban interface. In addition, time of year of harvest can play an important role in minimizing the lag time between harvest and treatment of the activity fuels. Overwintering of slash fuels is often a design feature to leach nutrients back into the soil. Harvest activities that take place in the late fall or early winter decrease the fire hazard because the activity fuels not only have a chance to overwinter, they are on the ground during periods of very low fire danger and can then be either grapple-piled or underburned come the following spring. At any rate, although an increased short-term fire hazard for high intensity surface fire exists following timber harvest, the chance for crown fire is nearly eliminated, as the other ladder and crown fuels have been removed or at least reduced.

b. Fuel accumulation – effectiveness of treatment

The effectiveness of the fuels treatments selected was discussed previously and additional fuels treatments in the future will be necessary to keep hazardous fuels at a level where low-intensity fire can be controlled by suppression resources. These activities can include precommercial thinning, continued biomass utilization, piling & burning, and prescribed fire, along with many other activities not proposed for this project but could be considered in the future (mastication, chipping, etc.). The silvicultural prescriptions should include a schedule of future entries for fuels reduction purposes.

7. Forest Plan and Other Regulatory Direction Consistency by Alternative

Under Alternative 2 (Proposed Action), Forest Plan compliance occurs through efficient fire protection and fire use to help accomplish land management objectives (Forest Plan, Chapter II, pages 10 and 38). Forest Plan Standards for fire management are listed below:

1. Fire protection and use standards are specified by management area. Cost effective fire protection programs will be developed to implement management direction based on on-site characteristics that effect fire occurrence, fire effects, fire management costs and fire caused changes in values.
2. The Fire Management Action Plan will be guided by the following Forest-wide standards:
    a. Management area standards.
    b. Human life and property will be protected
    c. Fire will be used to achieve management goals according to direction in management areas.
    d. Management area standards will be used in Escaped Fire Situation Analysis as a basis for establishing resource priorities and values.

e. The appropriate suppression response for designated old-growth stands in all management areas, except in wilderness, will result in preventing the loss of old growth.
f. Activity fuels will be treated to reduce their potential rate of spread and fire intensity so the planned initial attack organization can meet initial attack objectives.
g. Forest Fuel Management Fund expenditure priorities are:
    i. Natural fuels that pose a threat to human life and property
    ii. Unfounded activity fuel projects
    iii. Areas where fuels/fire behavior is a threat to management area objectives

Following is a description of how each alternative meets Forest Plan standards. Forest Plan standard 2d and 2e relate to wildfire suppression policy and requirements which are not affected by this project, and therefore compliance with these standards is not described. In addition, this project does not determine Forest Fuel Management expenditure priorities, so compliance with standard 2g will not be addressed.

Alternative 1 (No Action)

This alternative would not take any action to protect human life and property within the analysis area from an uncontrolled and unwanted wildfire. The No-Action Alternative would not use prescribed fire to help meet the goals of the management areas within the analysis area. It would not help develop cost-effective fire programs because it is reasonable to expect more intense fire behavior than in treated stands, thus control would be more difficult and likely require a greater number and type of suppression resources.

The continued lack of fuels management would be inconsistent with the Forest plan goals, objectives, and standards because of the continued trend in undesired fire behavior.

Alternative 2 (Proposed Action)

This alternative would be consistent with the Forest Plan as it proposes to use prescribed fire to help meet the goals of the management areas within the analysis area. This alternative would take action to reduce potential flame lengths and rates of spread – preventative steps towards the protection of human life and property within and adjacent to the analysis area in the event of a wildfire. The reduction of fuels will also help the initial attack organization meet their suppression objectives. This alternative would help develop cost-effective fire programs by reducing potential intensities of wildfires and therefore the costs of controlling potential wildfires.

This alternative proposes to reduce fuels across the most acres in the wildland urban interface; therefore, it better meets the goals, standards and objectives of the Forest Plan, as well as meeting the intent of the Healthy Forests Restoration Act of 2003 and the National Fire Plan.

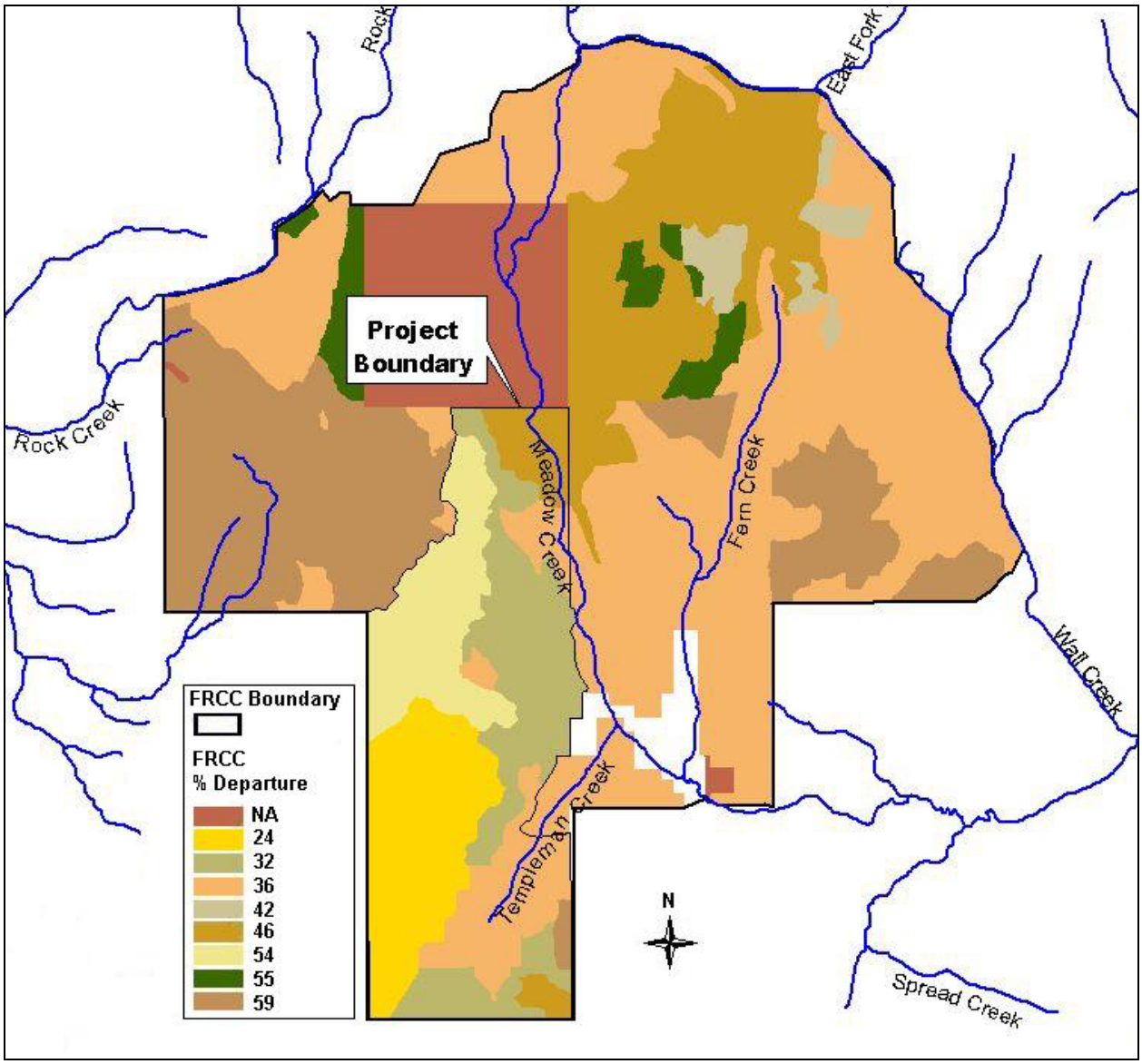
8. Summary

In the wildland urban interface, there is a high level of risk associated with fire. Not from the perspective of fire occurrence necessarily, although if we can learn anything from fire history it should be that all our forests have experienced fire and the next one in this area is only a matter of time. At any rate, the risk has to do with people and safety – the risk to the community in the event that there is a wildfire. When comparing the populations of the at-risk communities – Bonners Ferry and Moyie Springs – against the population of the entire county, it can be inferred that more than 65% of the residents are rural – and as people continue to seek out a private place to call their own – development into the forest will persist. The Camp Nine and Templeman areas are no exception to this, as they are surrounded by private land, residences, and people living and recreating in the forest. Therefore, even 1 fire start in 100 years may be considered too high a risk for forest managers with the current condition of the fuels and associated high fire hazard and expected fire behavior.

The bottom line of the National Fire Plan and 10-Year Comprehensive Strategy is to assist fire suppression efforts to protect communities and the people who live in them. By modifying fuels to reduce fire behavior, the proposed action will help meet these goals. The No Action alternative will not.

Appendix A

FRCC Departure for Proposed Action



Landscape Weighted Departure – 37% - FRCC 2

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